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The Australian Society for Limnology is an association of over 400 people with professional or amateur interests related to Australian inland waters Since its inception in 1961 the Society has played an important role in fostering limnological work in this country. The ASL promotes liason between limnologists in academic, private and governmental institutions and has a vested interest in the conservation of aquatic and related resources. Annual conferences are held near centres of limnological interest, and the programme includes scientific sessions, field excursions and social activities.

The ASL produces a newsletter with notes on activities, articles of general interest, book reviews and conference announcements; a Bulletin of original scientific papers and occasional Special Publications. A further publication is the Directory of Australian Limnologists.

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Congress Abstracts

Links Between Freshwater Ecological Research and Water Quality Criteria

P.S. Lake, Zoology Department, Monash University.

Rivers comprise the principal freshwater resource exploited in Australia. Past and present management practices of exploited rivers have been directed toward meeting off-stream domestic, industrial and agricultural demands. In the meeting of these demands, a comprehensive and realizable set of water quality criteria has arisen. Public pressure is now demanding that the needs of in-stream uses, especially ecosystem maintenance and possible ecosystem restoration, become goals of water managers.

In many cases such a goal is difficult to achieve due to the lack of basic research. To understand ecosystems requires long term research, yet such research has rarely been encouraged, let alone commissioned. In cases of obviously damaged ecosystems it is often possible to determine the damaging influences, even though a full explanation of the damaging effects is not available. Current ecological research suggests that riverine ecosystems (especially in Australia) are strongly under the influence of locally distinctive forces. Such a trend is incompatable with use of deterministic models (e.g. saprobiensystem) to manage riverine ecosystems. It also suggests that for sound management of stream ecosystems, local conditions prevailing for each ecosystem need to be understood and evaluated.

Drinking Water Quality Research in South Australia

D.J Lane, Manager, State Water Laboratory, Engineering and Water Supply Department, Bolivar South Australia.

Most of the research undertaken in South Australia on the quality of drinking water is carried out within the Engineering and Water Supply department by the State Water Laboratory at Bolivar.

In recent years research has concentrated on the identification and significance of the relativly high levels of organic compounds found in South Australian surface waters. In particular, attention is being given to the effect that these compounds have on chemical treatment processes including disinfection.

Increasing attention is being given to the biological management of reservoirs,

particularly in respect of the relationship between phytoplankton and zooplankton. Work on the optimisation of copper sulphate dosing for algae is also in progress. The establishment of an association between amoebic meningitis and public water supply systems in South Australia has led to extensive research being undertaken on factors affecting the growth of Naegleria fowleri in pipeline systems and on the development of control measures.

Sampling to Determine Water Quality Parameters

A. Peck, CSIRO Division of Groundwater Research

In most cases, quality parameters of a water body are determined by analysis of samples rather than continuous measurement. The samples may be taken at regular intervals of time, regular intervals of flow or irregularly, and the primary objective may be to establish time -or flow- averaged concentrations, or to establish the continuous function of concentration vs time. The theory of sampling and time series analysis can make valuable contributions to the design of a water quality moitoring programme and the analysis of results. A long series of measurements of chloride concentrations in a stream draining a small catchment in Western Australia have been used to illustrate some of the statistical methods and the estimation of mean time -and flow- weighted concentrations.

Effect(s) of Fish Predation on Zooplankton - An Experimental Approach.

Phillip T. Arumugam, Department of Zoology, University of Adelaide.

Most work on the effect of fish on zooplankton suggest that when zooplanktiverous fish are present in a lentic ecosystem, larger zooplankters are rare or absent in the community. However, some studies show that large zooplankters can occur when fish are present. The type and density of fish present in a particular system probably play an important role in determining the size distribution of zooplankters.

To further investigate the importance of fish density on zooplankton community structure, plastic enclosures with low and high fish density and without fish were used, arranged in an experimental design. Two native fish fry, silver perch and golden perch were used as zooplanktivors.

Results from two experiments indicate that when fish are present, Daphnia is rare or absent and the zooplankton is dominated by smaller species. However, some problems were encountered with the use of enclosures viz. oxygen deficiency algal blooms, fish capture and disappearance. These problems will be elaborated.

An Electrophoretic Evaluation of the Taxonomy of the Freshwater Crayfish Genus Cherax

C.M. Austin, Department of Zoology, University of Western Australia.

Freshwater crayfish belonging to the genus Cherax are of considerable ecological importance and the group is of inherant evolutionary interest. Cherax however, is a taxonomically difficult group due to the high degree of morphological variation in and between populations. The technique of gel electrophoresis has been applied to critically evaluate the current taxonomy and provide a basis for taxonomic revision.

Levels of electrophoretic variation are low within populations but often high between populations, necessitating comprehensive geographical sampling within species. Standard methods of electrophoretic data analysis reveal that there is no evidence for recognition of 9 of 23 species examined, with three additional species being of doubtful status. The remaining eleven species are judged to be valid species by biological and phenetic criteria. In addition, two species new to science have been identified from the tip of Cape York. A poor understanding of the relationship between habit and morphology has apparently been one of the main factors leading to the proliferation of named species.

Plant and Invertebrate Succession in a Shallow High Altitude Lake After Drying

J.M. Backhouse, Department of Ecosystem Management, University of New England.

Llangothlin Lagoon (altitude 1360 m, surface area 400 ha, maximum depth 2 m) is located on the New England Tablelands of New South Wales. It dried out before April 1981 and began flooding in June 1981; it has held water ever since. Six months after flooding, a plant community dominated by Eleocharis sphacelata and Myriophyllum propinquum was re-established. From November 1981, plant cover in the sampling area was never less than 90%. From August 1981, invertebrates at six tansect points, 30 meters apart were samples monthly until July 1983. Ostracoda, Cladocera and harpacticoid Copepoda were present throughout and Cyclopoida for all but two months. Conchostracha and Lepidurus were present for about three months after flooding; there were not found in previous studies. The insect fauna was dominated by Chironomidae and Hemiptera. Although Coleoptera were uncharacteristically rare, this fauna is characteristic of temporary rainpools; this is remarkable because the lagoon has at most dried out only five times this century with eight years being the shortest interval between dry periods. Increasing density of vegetation caused the disappearance of expected groups such as calanoid copepods and certain ostracod species, and the frequent occurance of Gastropoda in the water column.

Multivariate Macroinvertebrates: Habitats and Headaches in an Australian Upland Stream.

L.A. Barmuta, Department of Zoology, Monash University.

Intensive investigation of a single site on the Acheron River over one year shows that the benthos is strongly affected by current speed, with a number of "sub-communities" being readily associated with the distinct suites of environmental factors. Most of the structure within the data is conferred by relatively few species with most of the common taxa occuring in similar abundences throughout all identifiable habitats. This multivariate approach to descriptive studies provides a firm basis for sound experimentation and shows the deficiencies in some of the accepted generalizations about macroinvertebrates and the abiotic factors that have been invoked to describe their distribution.

The Evolution of Australian Daphnia

J.A.H. Benzie, Department of Population Biology, Research School of Biological Sciences, Australian National University.

The phylogenetic and biogeographical relations of Australian Daphnia to each other and to species overseas are examined. These data are used to assist the interpretation of aspects of the population structure and evolution of the genus in Australia. The implications for evolutionary studies of other parthenogens and particularly zooplankters is discussed.

Potential Use of Algal Growth Inhibitors

Kathleen H Bowmer CSIRO, Centre for Irrigation Research.

A report prepared for the Department of Conservation and Environment, Western Australia, reviews the potential of algistats for the management of cyanophyta in the Peel-Harvey estuary. Various chelates of copper, dichlone, diquat, endothal, diuron, hexazinone,simazine, ametryn and terbutryn were considered innitially. Terbutryn is preferred because it is effective at low concentrations, has a relatively wide safety margin for fish, and is cheap and easy to apply in granular form. It also appears to be selective, having little effect on diatoms, which are important in generation zooplankton numbers and in maintaining fishery production. Algistats might also be useful in

maintaining the transmissivity of saline solar ponds, and in managing blooms of cyanophyta in freshwater storages.

The Importance of Biological Input in the Design Stage of Freshwater Treatment Ponds

P.F. Breen, Water Studies Centre, Chisholm Institute of Technology, now at CSIRO, Centre for Irrigation Research, Griffith.

Freshwater treatment ponds (WTPs) are suitable for treating a variety of wastes and are used widely throughout Australia. They are a particularly attractive treatment device for small communities because of their low construction and maintenance costs.

Biodegradable wastes are metabolised in WTPs by a variety of bacterial processes. The aerobic component of this bacterial decomposition creates a significant oxygen demand which in WTPs is largely met by the photosynthetic activity of algae. As such, algae are an extreamly important functional component of WTPs. The major factors affecting phytoplankton and the overall treatment process in WTPs are retention time, temperature and substrate concentration and composition. All these factors have been found to be seasonally dependant.

Aspects of phytoplankton behaviour were studied in WTPs at Bacchus Marsh, Victoria. Temperature and substrate composition were found to be the major factors effecting the phytoplankton in this system. The influence of these factors was both related and varied spatially and temporally within the pond system. Temperature influenced algae directly and indirectly by influencing bacterial activity which in turn affects substrate composition. The Bacchus Marsh systen was found to be over-designed with respect to retention time. A number of design recommendations are suggested that would take into account the seasonal activities of processes occuring in WTPs.

Influence of Inorganic Sediment on Detritus Processing by Stream Invertebrates

Stuart Bunn, Department of Zoology, University of Western Australia.

The importance of detritus as the principal source of energy for stream invertebrate communities is well documented, particularly for North American systems. However, few studies have examined the effects inorganic sediment has on the utilization of this detritus.

Forest clearing activities in the northern jarrah forest, Western Australia, have resulted in increased sedimentation of some headwater streams. Initial leaf bag

experiments in an undisturbed stream demonstrated litter breakdown by invertebrates to be a slow process. This is due more to the poor quality of detritus rather than the absence of a suitable fauna. This paper will discuss the pattern of litter utilization by stream detritivores, and the effect inorganic sediment has on this process.

Are Water Supply Engineers to Blame for Their Algal Problems?

Frank L Burns, Consulting Engineer, Glen Waverley Victoria.

The recently published report "Water 2000 : A Perspective on Australia's Water Resources to the Year 2000", was accompanied by a consultents report (no.7) entitled "Water Quality Issues", which identified algal problems as being of high national importance, and of increasing severity, in Australian water supply systems.

This presentation, from a water supply engineer, will suggest that these problems are largely created by our reluctence to give up out-dated design and operation practices. This opinion has developed over a number of years of observing reservoirs as living systems, instead of inanimate masses of water, and having the opportunity to try out several ideas suggested by fellow limnologists.

If algae are a problem, why do we persist in building elaborate and expensive structures in order to draw water from the algal infested upper regions of the reservoir?

Do we really know what we are doing to this living system when we go to the trouble of dosing it with copper sulphate?

These, and other outdated legacies from past practices, will be discussed, with examples of more effective and economical practices which have been tried and found to work.

Growth and Nutrition of Azolla spp., and Nitrogen Fixation in Flooded Rice Culture.

P.R. Cary and P.G.J. Weerts, CSIRO Centre for Irrigation Research

The effects of nutrition and water temperature on the growth of Azolla spp. (A.primata and A.filiculoides) have been examined under controlled conditions (in greenhouse) and in the field.

The main objective was to study the effect of phosphorus supply on the Azolla-Anabaena symbiotic nitrogen-fixing system, which has great potential for reducing N fertilizer requirements in rice rotations.

Phosphorus Removal by Wetland Plants in the Harvey Catchment, Western Australia.

Jane M. Chambers, Botany Department, University of Western Australia.

The advanced state of eutrophication of the Peel-Harvey estuary, Western Australia, has generated considerable research into methods to solve this problem. The major aim of this study was to asses various management options involving wetland plants to remove phosphorus from water of the surrounding agrecultural catchments before it entered the estuary. The options included fringing agricultural drains in the catchment with wetland plants, diverting this runoff through natural wetlands, or using "artificial wetlands" at the outlet of major drains and eutrophic swamps and to treat point source effluent.

Experimental work showed that the wetland plant studied, Lepidosperma longitudinale, was most efficient at removing phosphorus from water at low flow rates ($2.41 m^{-2}$ of wetland day^{-1}) and high phosphorus concentrations (10-20 $mg l^{-1}$). The high flow rates and low phosphorus concentrations associated with agricultural runoff and drains made the use of wetland filters at these sites unfeasable. Diversion of runoff through existing wetlands was also not recommended as the majority of wetlands in the area had higher phosphorus concentrations than the agricultural runoff they were to treat. The use of "artificial wetlands" at the outlet of eutrophic swamps and point sources is likely to be effective due to low flow rates (which could be controlled) and high phosphorus concentrations.

Waste Water Treatment - A Review of Artificial Wetland Research

Alan J. Chick and H. J. Bavor, Hawksbury Agrecultural College

Research into the use of both natural and artificial wetlands for the amelioration of waste waters has received increasing attention over the past decade. This paper presents a brief outline of work carried out in some overseas countries, and describes research now being done in Australia using emergent aquatic macrophyte trenches. Some preliminary results on N and P removal are presented with an indication of the potential for improvements. Planned research, aimed at producing design criteria for treatment systems, is outlined.

Comparison of Spatial Distribution and Abundence of Brine Shrimp, Artemia Located in Tufa Shoals and Pelagic Regions of Mono Lake, California

Frank P. Conte, Scientific Director, Dircon Consultants, Corvallis, Oregon USA

Spatial distribution and abundance of brine shrimp populations in Mono Lake were studied during 1982 and 1983. Sampling techniques used included vertical hauls of zooplankton nets, Schindler-Patalas traps and a newly devised diaphragm vacuum pump system. Capture efficiency for nets and pump system were made at 11 different collecting sites and assumed the Schindler-Palalas trap method to be 100% efficient. The observed capture efficiencies varied with depth; net and trap systems are 25% less efficient than pump systems at depths shallower than three meters whereas pump systems had maximum avoidance by shrimp at depths ranging from ten to fifteen meters. Capture analysis for 1982-83 brine shrimp population from a lakewide sampling survey will be present and horizontal and vertical distribution patterns will be discussed. Mono Lake will gradually decline in elevation forty feet and increase in salinity in the next 80-100 years due to the diversion of fresh water from the Mono Basin to the City of Los Angeles. On February 17, 1983, the California Supreme Court made a landmark ruling on Los Angeles request for renewal of its water use permit. The ruling stated that the benefit received by Los Angeles by the continued use of water from Mono Basin must be balanced against whatever adverse effects are determined to occur to the Mono Basin environment. These impacts are currently being investigated by a consortium of researchers from universities and private industries.

A Physicochemical and Microbial Study of Lake Fidler and Sulphide Pool, Tasmania

R. Croome, Botany Department, University of Tasmania.

Lake Fidler and Sulphide Pool are small, dystrophic, meromictic lakes adjacent to the Gordon River in South West Tasmania. Partitioning between upper and lower waters is very distinct in both lakes, and a stratification of micro-organisms is situated about a particularly abrupt redoxcline at around three meters depth in Lake Fidler and two meters depth in Sulphide Pool. A special close interval sampler was developed specifically to sample the fine zonation of these organisms. The microbes in Lake Fidler comprise small flagellate algae, colourless sulphur bacteria and green photosynthetic bacteria. In Sulphide Pool a similar stratification occurs but lacks colourless sulphur bacteria. Extremely large standing crops of photosynthetic bacteria are present in the

two lakes, and the algae of the stratified communities are also present in large numbers, particularly in Sulphide Pool. The organisms of the microbial arrays which photosynthesise do so at very low levels of red light. The physicochemical limnology of the lakes, structure of the microbial stratifications and the taxonomy, ecology and physiology of the organisms within them are discussed.

Phylogeny and Historical Biogeography of the Australian Psephenidae

Dr Jenny Davis, Department of Civil Engineering and Zoolology Department, University of Western Australia.

Many researchers have stressed the importance of basing zoogeographical analyses on strictly phylogenic classifications. This paper describes cladistic and phenetic analysis conducted on fourteen species of Sclerocyphon (the sole Australian genus of the Psephenidae) on the basis of larval characters. A Gondwanaland origin of the genus is proposed and a vicariance model is used to explain distribution patterns of the fourteen species in Australia. This model invokes the occurence of three widely dispersed ancestral species, their probable distributions and relationships to extinct species is discussed.

Water Quality of Lakes Near Casey Station, Antarctica

Patrick De Deckker, Department of Biogeography and Geomorphology, Australian National University.

Forty-three lakes in the vicinity of the Australian Antarctic Base, Casey Station, were sampled during the summer season, January 1983. Lakes on the Antarctic mainland, and nearby peninsulas and islands, were visited to determine their water quality. The purpose of the work was also to find out whether any relationship existed water chemistry and the local geology, since around Casey a variety of geological formations occur, all consisting of Precambrian metamorphic rocks.

No saline lakes of salinity >10°/oo were found. Only nematodes, tardigrades, rotifers and algae were found in the collections, despite a previous record of copepods in some lakes near Casey. Cyanobacterial mats were rarely encountered. The significance of all these findings is discussed.

The effects on water quality by penguin rookeries and by human activity in the vicinity of some of the lakes is documented, and suggestions for future preservation of

the aquatic environment near the Station are presented.

The Role of the River Murray in the Ecology of the Coorong Lagoons

Michael C. Geddes, Zoology Department, University of Adelaide

The Coorong lagoons stretch 100km south east of the River Murray. In the lagoons there is longitudinal, vertical, and seasonal variation in salinity; salinities range from freshwater to four times seawater. Salinity affects the distribution of the macroinvertebrates and the macrophytes in the lagoons. During periods of low salinity, freshwater and estuarine/hypomarine species occur, while species characteristic of inland saline lakes occur at times of high salinity. At high salinity the limited flora and fauna may not provide suitable conditions for fish or for the internationally renowned bird life. The major factor controlling salinity patterns in the Coorong is outflow from the barrages at the mouth of the River Murray. Thus continued flow regulation in the River Murray poses a serious environmental threat to the ecology of the Corrong.

Production of Australian Bass (Macquaria noveamaculata) in a Lagoon

John H. Harris, School of Zoology, University of New South Wales.

The demography of a bass population was studied in a 3.4ha lagoon on the Colo River flood plain near Sydney. A multiple mark recapture experiment and other sampling provided data for two estimates of annual production, using the Ricker tabular method and the Allen curve graphical method.

Bass were found to be sparsely distributed through sheltered parts of their habitat, and total mortality was low (z=0.28). Annual somatic production was very low ($0.84 gm^{-2} yr^{-1}$).

However, the striking feature of the experiment was the exceptionally low P/B ratio (0.19). This is characteristic of such catadromous species, in which the relativly high production of younger age groups is based on richer estuarine environments far from the habitat of adult fish.

Application of Algal Assays for the Indication of Nutrient Availability in Natural Waters

C.W. Heath, S. Shaw and I.C. Smalls , Sydney Water Board.

The Sydney Water Board has utilized batch cultures of Scendesmus obliquus as an indication of the algal growth potential of natural waters in the Sydney region.

Tests have been carried out on riverine and reservoir waters using varied pre-treatments to remove wild species. Results indicate a relationship between phosphorus and crop at the end of exponential growth.

The logarithmic relationship for Nepean River samples has been shown to be linear, but with an inflexion point and decreasing response above 100mg $m^{-3}PO_4$-P. The environmental and quality implications will be discussed.

Algal Growth and Nutrient Input at Lake Mulwala

T. Hillman, Albury Wodonga Development Centre.

Phytoplankton biomass bata collected routinely during the period 1977-81 are presented. Seasonal patterns are analysed, comparing data from Lake Hume and Lake Mulwala. Major taxa exhibit seasonal patterns of abundence, some of which appear to vary significantly between sampling sites. The influence of physical and chemical parameters is assesed statistically, with some discussion of patterns of nutrient input to Lake Mulwala.

Macrozoobenthos of the Ok Tedi Region, Papua New Guinea

Kent G. Hortle, Environment Section, Ok Tedi Mining Limited.

The Ok Tedi Mine, located in the headwaters of the Fly River System, is Papua New Guinea's biggest new mining project, and has potential to cause major changes in the fauna of rivers in the region.

After an initial survey in February 1983, macrozoobenthos surveillance is being carried out at five locations in the upper Ok Tedi catchment. Difficulties in using standard methods were caused by the large size, speed and great short term variations in flows of rivers in this area.

Results to date indicate that the benthic fauna is characterised by a low diversity and density, with a few species of ephemeroptera dominant The causes of these characteristics are discussed. The effects on the fauna of increased sediment loads due to pre-mining activities are evaluated, and conparisons are made with benthic fauna at other localities.

Evidence for a Reproductive Moult in the Freshwater Crayfish Genus Engaeus

P. Horwitz, Department of Zoology, University of Tasmania.

Female freshwater crayfish of the genus Engaeus, at least, can be designated as being either reproductivly active or non-reproductive on the basis of gross mophological changes. These include differences in the length and width ratios of the abdomen and its appendages, as well as genital pore parameters.

It is proposed that a reproductive moult immidiately prior to mating takes place in these crayfish.

The implications of this information with regard to the phylogeny of freshwater crayfish and the arificial induction of breeding will be discussed.

Endangered Fish in the Lower River Murray

Lance Lloyd, Department of Zoology, University of Adelaide.

The distribution and conservation status of the freshwater fish of Australia have, until recently, been neglected but new publications have redressed this neglect for fish in New South Wales, Victoria and Western Australia. This paper considers the distribution and conservation status of fish in the South Australian Murray. Based on a survey undertaken between 1982 and 1984, museum records and published literature, a number of fish are considered endangered in the lower River Murray. River blackfish (Gadopsis marmoratus), purple spotted gudgeon (Mogurnda adspersa), chanda perch (Ambassis castelnaui) and pigmy perch (Nannoperca australis) are all considered endangered because of their retricted and patchy distribution, small population sizes and threatened habitats. Many species are considered to be vulnerable because little is known of their biology or distribution and no species can be considered secure due to continuing exploitation of water resources, habitat modification and agricultural practices. Finally a plea is made for a systematic, national survey of freshwater fish in Australia to asses their conservation status and suggest appropriate conservation measures.

Nutrient Loading and Water Quality in Wilson Inlet, Western Australia

R. Lukatelich, N. Schofield and A. McComb; University of Western Australia and Public Works Department Western Australia.

Wilson Inlet is an esturine basin on the south coast, seasonally closed off from the ocean by a sand bar. Although ambient nutrient and chlorophyll levels are low, in recent years there have been massive growths of the aquatic plant Ruppia. Seasonal changes in

the biomass and nutrient content of this plant were measures and nutrient inflow to the basin estimated by measuring streamflow and nutrient concentration. Plant tissue nutrient levels suggest phosphorus is important in controlling plant growth, and the estuary showed net phosphorus retention. The amount of phosphorus in plant tissue was large compared with the amount entering in streamflow. Phosphorus loss was high from those parts of the catchment with sandy soils, cleared for agriculture, and in high rainfall areas.

Diatoms in Water Quality Assesment

Patrick McBride, Jabiru Research Institute, Office of the Supervising Scientist.

The structure of periphytic diatom communities was used to assess the environmental conditions within test enclosures in a tropical waterhole. Differences in these diatom communities suggested differences in water quality which were not obvious from the physical and chemical parameters and conversely differences in physical and chemical parameters appeared to have little effect on the biological environment.

Limnological (Stream) Reference Areas : An Urgent Need.

Luisa A. Macmillan, Architecture Department, R.M.I.T., Melbourne.

To date, minimal recognition has been given to the need for limnological reference areas, and systematic approaches for identifying and classifying such areas are only now being developed. Some overseas tecniques for classifying stream types for conservation purposes will be outlined and a broadscale approach using catchment features - climate, physiography and geology - is detailed. A filter system is applied to East Gippsland streams to identify potential stream reference areas, and an assesment of their existing tenure and likely future status is made.

Macroinvertebrates of the Upper LaTrobe River

R. Marchant, Survey Department, Museum of Victoria.

Seventeen sites were each sampled six times over two years for macroinvertebrates. A range of physico-chemical variables was measured concurrently to determine which factors influenced the distribution of species. Numerical classification of the faunal data indicated four groups of sites or communities were distinguishable: lowland sites; sandy upland sites; cobble upland sites from the northern catchment; cobble upland sites from the southern catchment. Multiple discriminant analysis and multiple regression analysis demonstrated that particle size of the sediment,

concentration of dissolved ions and altitude were the physico-chemical features that had most influence on the faunal distribution. The abundances of shredders and predators did not vary between the site groups while those of scrapers, gatherers and filterers did : scrapers were most abundant at cobble sites while gatherers and filterers were least abundent on sand and increased in abundance downstream. The distribution of these feeding groups, except the shredders, generally agreed with those predicted by the River Continuum Concept. The abundances of the total fauna were inversely related to the level of benthic organic matter. This feature and the anomalous distribution of the shredders suggest that the nature of the benthic organic matter in temperate Auatralian streams is not well understood.

Selective Grazing of Phytoplankton by Zooplankton

Chester Merrick, Botany Department, University of Adelaide.

In situ filtering rates were determined for several common zooplankton in Mt.Bold reservoir (South Australia) using ^{14}C labelled algal tracers. Specific preferences for different food size-fractions and the influence of turbid water were examined. In agreement with the literature, Cladocerans fed on the small size-fraction while Copepods preferred the larger food. Contrary to accepted literature, Copepods were found to have comparable filtering rates in the field to Cladocerans of similar size. Filtering rates of both groups of zooplankton are significantly reduced in turbid conditions. The relevance of these findings to the seasonal population dynamics of the zooplankton is discussed.

2B or not 2B : or How Many Samples Should You Collect

Richard Norris and Arthur Georges, School of Applied Science, Canberra College of Advanced Education.

The cost of environmental studies is determined largely by the number of samples which need to be collected and analysed to obtain precise estimates of the factors measured. In this study, as in others using counts of benthic invertebrates, the variance was greater than the mean. Also, there was a strong linear relationship between the standard deviation and the mean $r=0.97$, $p=0.001$, $df=78$. The traditional log $(x+1)$ transformation successfully broke the relationship $r=0.04$, $p=0.37$, $df=78$. A precise linear relationship between the mean and the variance may be adopted; $\log S^2 = \log a + b \log X$. As the present study $\log S^2 = 0.0921 + 1.5971 \log X$, and 93% of the variation in $\log S^2$ can be explained by the variation in $\log X$. Thus the variance may be eliminated from the traditional equation calculating the number of samples required to yield an estimate of the mean with the required precision:

$$N = \frac{a\bar{X}^{-b}}{\bar{X}^2 D^2} \quad \text{or for this study } N = \frac{1.2362\bar{X}^{-0.4029}}{D^2}$$

Where: N=number of samples required and D=required precision. The number of samples is affected little by a which is close to one, and most affected by the power b which at 1.59 conforms well within a range of other biological data and is not equal to 2 as has been suggested. This critical value of b whether for biological or physicochemical samples will depend on the range of densities (or concentration) and the hetrogeneity of the environment.

Water Quality and Benthic Biota of Blackwater Creek, Central Queensland

P.M. Outridge, G.J. Miller, R.J. Neller, J.H. Powell and E.C. Stock, School of Environmental Studies, Griffith University.

A twelve month survey of water quality and benthos in Blackwater Creek showed that the predominant influences on the system were its intermittant yet intense flow regime, and sewage waste discharges from Blackwater township. Consequently, a feature of the creek's water quality was extreme temporal and spatial variability, particularly in dissolved oxygen, macronutrients, faecal coliforms and algal biomass.

Thirty eight taxa of benthic invertebrates were identified, consisting mainly of chironomids and the oligochaete Branchiura sowerbyi. Stream pools below the sewage outfall usually contained the highest number of individuals and species. Benthic community characteristics were significantly affected by conductivity, dissolved oxygen, Mg, Fe and total P in water, and by Cu, Ni, B, Mn, Mo and total P in sediments. Wet season flooding led to a significant reduction in all community parameters except biomass, although recovery to pre-flood conditions occured in less than four months.

Fish Scale Age Analysis Using the Scanning Electron Microscope

Bryan E Pierce, Department of Zoology, University of Adelaide.

Scales have commonly been employed to determine the ages of individual fish. Unfortunately, the yearly discontinuities in circuli formation (annuli) caused by growth reductions in winter are often weak or lacking in tropical or subtropical forms. The scanning electron microscope provides the potential to quantify total scale circuli, inner circuli distances, circuli heights, and possible annuli or accessory annuli

formations. Practical techniqueswere developed to apply this tecnique to a series of bony bream (Nematalosa erebi) scales. Results are compared with data obtained by standard (light microscope) examination of scales and analysis of length frequency data using a standardised microcomputer programme (ELEFAN I). The potential for and value of this method in future applications is considered.

The South Australian Mound Springs and their Endemic Aquatic Invertebrates.

W.F. Ponder, The Australian Museum, Sydney.

The artesian mound springs in the north of South Australia between Marree and Oodnadatta contain ten species of hydrobiid snails in two endemic genera, an isopod and ostracod beloging to endemic subfamilies, as well as an endemic species of amphod and flatworm. The snails show speciation patterns that generally conform to the distribution of the groups of springs. Up to five species of snail occur in a single spring and have either ecological differences or differ significantly in size. High densities are achieved, with over 1 million snails to the square meter being recorded. Dalhousie Springs, north of Oodnadatta, have additional species of snails in another endemic genus.

The South Australian mound springs are a unique and important habitat of considerable biological interest and great potential for ecological and evolutionary studies.

Aspects of Thermal and Oxygen Attributes of New South Wales Reservoirs

E.A. Scribner, Fisheries Division, New South Wales Department of Agriculture.

Data on twenty-five New South Wales reservoirs, obtained over the period 1972-1980, show that, as expected from their altitudes and latitudes, most are warm monomitic. The depths of the thermoclines in late summer vary from 2 meters to about 20 meters, depending on size and morphology. Surface temperatures at this time are mostly in the range 20-25^{o}C, and demersal temperatures mostly in the range 10-15^{o}C

Most reservoirs studied show some degree of demersal anoxia during late summer, and almost all had distinctly orthograde oxygen curves, although the two most oligotrophic (Eucumbene and Blowering) had very little oxygen depletion.

These attributes are likely to lead to:

(a) generally marginal or poor conditions for salmonids and;

(b) problems with the use, during late summer, of demersal water for domestic supply, particularly from odour (due to hydrogen sulphide and organic sulphides), staining

of clothes and porcelain (due to iron and maganese) and corrosion of fittings (due to high carbon dioxide). These problems may be overcome by either withdrawal from selective depths (variable offtake) or destratification. Use of the latter is now very much on the increase.

Aquatic Insect Emergence from Waterbodies At and Nearby the Ranger Uranium Mine, Jabiru, Northern Territory.

Tony Sharley, Northern Territory Museum, Darwin.

Floating traps were used to sample emerging insects from aquatic larvae in three natural waterbodies of the Magela Creek system and two artificial ponds at the Ranger Uranium mine. Trapping continued for one lunar month (full moon to full moon) in the late dry, wet and dry seasons of 1982/83. Further sampling with hand nets and a light trap in Corndorl Billabong and Ranger Trailings Dam provided emergent fauna for analysis of six heavy metals (Cu, ZN, Mn, Pb, Cd, U) and the radionulide Radium-226.

One hundred and seven species belonging to four orders (Dipteria, Trichoptera, Ephemeroptera, Odonata) were trapped during the two year study; the natural waterbodies having the richest fauna but not always the most productive. Midges (Diptera : Chironomidae) dominated the emergent fauna in all waterbodies with forty species occuring in the study area.

Wet/dry season trends in insect emergence and the potential transport of contaminants from natural and artificial waterbodies via aquatic insects are discussed.

Rotifers and Water Quality

Russ Shiel, Botany Department, University of Adelaide.

Some 600 species of Rotifera are known from Australian inland waters, with 15% endemicity. Species assemblages rather than individual species are good indicators of water quality. Studies on Mt Bold Reservoir, South Australia demonstrate that specific food preferences may exert significant pressure on food items, eg. Ascomorphella volvocicola/Volvox and Synchaeta pectinata/Carteria. Responses of the rotifer fauna to environmental changes are extremly rapid; for example a spring pulse of Synchaeta et al reached >25 000 l^{-1} in three days in Mt Bold; densities > 70 000 l^{-1} are recorded from the Northern Territory. Summary data from studies in South East Australia, Northern Territory and Western Australia are presented. Time permitting, a film on rotifers and their feeding will be shown.

The Phosphorus Content of Yarra River Suspended Sediments

Phil. Sinclair, Water Studies Centre, Chisholm Institute of Technology.

This study of the Yarra River has shown that suspended sediment from the upstream site (Warrandyte), had a higher mean phosphorus content than the downstrean site (Chandler Highway). However the medial load of suspended sediment phosphorus was more than twice as high at the downstream site. Examples for high and low flow situations are used to show the effect of spates of the phosphorus content. Treatment of the suspended sediment with anion exchange resin and by sodium hydroxide indicated that more of the phosphorus was extractable as Warrandyte. However, loads of the extractable phosphorus forms were greater at Chandler Highway and spates delivered greater loads of these forms than did low flow conditions. These extractions give an indication of what portion of the suspended sediment phosphorus may be available to biota and the results have implications for the management of the Yarra System, especially the offstream storage; Winneke Reservoir.

The Macroinvertebrate Fauna of the Northern Para River : A System Exposed to Winery Waste Discharge.

P.J. Suter, State Water Laboratory, Engineering & Water Supply Department, South Australia.

The North Para River is an intermittent stream which drains the winery area of the Barossa Valley, in South Australia. During periods of high flow controlled discharges of winery wastes from lagoons into the river are authorised under the Water Resources Act by the Minister of Water Resources through the North Para Water Advisory Committee.

A study to investigate the impact of these discharges on the macroinvertebrate community of the North Para River Commenced in July 1978 and continued until October 1981. Direct comparison of seven locations along the North Para River was made based on species diversity, and the presence and absence of pollution sensitive groups of animals.

A total of 136 taxa of benthic invertebrates (excluding unidentified juvenile specimens, Oligochaeta, Hydracarina and Turbellaria) were identified.

Three sites had reduced species diversity, and two groups of species appear to avoid them. Two of these sites received winery effluent but one was above any winery waste inputs.

The release of winery effluent during periods of high flow in the North Para River does not appear to cause long lasting effects to the invertebrate community in space or time.

Management of Piccaninnie Ponds and Ewens Ponds

G. Tedder, National Parks and Wildlife Service.

Of the freshwater sinkholes in the south east of South Australia, Piccaninnie Ponds and Ewens Ponds are subject to the greatest use by divers. The effect of divers on the fragile ecosystem of the ponds can only be estimated, however it appears that the condition of Ewens Ponds is declining.

Piccaninnie Ponds is part of the Piccaninnie Ponds Conservation Park and some control over use is exercised under the National Parks and Wildlife Act 1972, in contrast Ewens Ponds is the responsibility of the Lands Department and is not controlled at present.

Damage by divers is both by physical disruption of vegetation and disturbances of sediment. The effects of frequent sediment disturbance on the aquatic flora and fauna in unknown. The use of both ponds is increasing and methods to determine a maximun number of divers (carrying capacity) are being considered.

Dynamic Aspects of Trace Metal Speciation in Aquatic Environments

T.D. Waite, School of Chemistry, Melbourne University.

The speciation of trace metals in natural waters is critical in controlling both the transport of metals within the aquatic environment and the interaction of metals with aquatic organisms. While thermodynamic considerations provide a great deal of insight into the likely trace metal speciation, non-equilibrium factors must also be considered. In particular, the kinetics of complexation, precipitation and oxidation reduction reactions may effectively determine the speciation of some elements. Under certain conditions, external forcing functions such as light may introduce time varying changes in the rates of such reactions. While the speciation of trace metals in bulk solution has been studied extensively, attention should also be given to the impact of reactions in microenvironments, such as the colloid surface-solution interface, organism membranes and the solution-air interface as these environments are often the loci for rapid changes in metal speciation.

Cathy Yule plecopterist extraordinaire in action — "don't you know anything?"

Jane Chambers threatens the audience with detention unless they stop talking and pay attention

The morning after the dinner and Jenny Davis, clutching a pointer to assist her to remain upright, attempts to explain the occurence of psephenids at Kalgoorlie

Phil Suter, conference supremo, wheeling and dealing

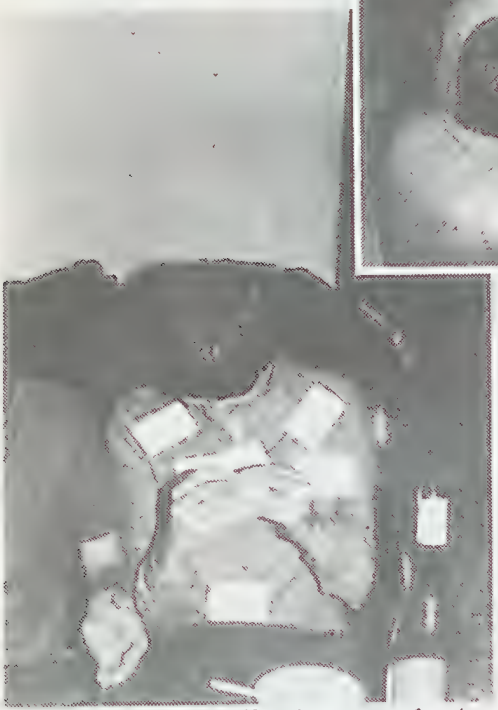
The Western Australians tended to stick together. Here Stuart Bunn gives Jenny Davis a freindly stab in the back.

George Ganf attempting to convince Margaret Hart that the society should offer concessional membership rates for sexy senior citizens

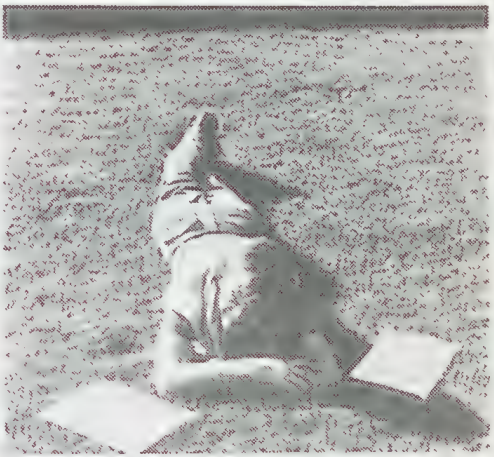
David Mitchell gives Melanie Hillman the run around at the bush dance

Jane Moller, having consumed a bottle of port (courtesy of G. Ganf) excitedly expounds on the joys of doing a PhD

The executive in action (is that one word or two?) During a crucial stage of the first meeting. Jane Chambers fortifies herself with another drink (her seventeenth but who's counting?) Leon Barmuta is already asleep (but still drinking!)



The drug squad have offered vast sums for the negative of this photo of Ros St Clair



Dieter Diem demonstrates a Swiss roll

Sandra Sdraulig of Chisholm Institute offers confidential government files for sale to the highest bidder during a lunch break

The 1984/5 Executive in a typical pose. Standing (L to R) Leon Barmuta, Stuart Bunn, Barry Hart (smiling - where are his hands?) Margaret Hart (disgusted - oh there!) Terry Hillman (unimpressed by the quality of the wine) John Kirk, Ros St Clair, Phil Suter, Tony Sharley. Front row: Jenny Davis, Jane Chambers, Ian Campbell.

At the dinner George Ganf (left) easily beats Ian Bayly (centre) in a race to count their fingers. Sam Lake (extreme right) who has trouble counting his hands, looks on astounded

At the dinner Mike Geddes (left) gives Fred Reynolds a friendly squeeze. When he tried the same technique on Elizabeth later the slide show was severely disrupted

Neil Hallam (left) the guest speaker at the dinner with Peter Breen (centre) and Barry Hart. What bald patch?

Tony Sharley (who doesn't smoke) is caught out again while Peter Outridge looks on.

Shell Shapes Analysed by Computer.

K.F. Walker, Department of Zoology, University of Adelaide.

Our eyes are well able to recognise differences in the shape of objects, but it is often difficult to specify those differences in a form suitable for comparative analysis. The conventional approach is to use linear dimensions (eg length and height), although the results may be quite misleading. More precise methods have existed for a long time, but the length of calculations involved has discouraged their use. This has changed with the advent of computers. One computer based method, Fourier Analysis, represents any given shape as a summation of simple harmonics (waveforms offset from one another by phase angles, and with amplitudes governed by Fourier coefficients). The proceedure is illustrated by analysis of a series of freshwater mussel shells. A basic requirement of the method, and one that causes some difficulty with shells, is the need to locate a point of homology valid for all specimines. Even so, the results do provide for effective discrimination and, importantly, do indicate the extents of differences among shells.

Tropical Australia - A Dynamic Limnological Environment

T.D. Walker and P.A. Tyler, Botany Department, University of Tasmania.

The Northern Territory of Australia, the "Top End", is richly diverse but barely known. The mining of vast uranium deposits in the Allegator Rivers Region drew Government money, in prodigious amount, for ecological research and environmental protection, giving the first concerted look at tropical limnology in Australia.

The receiving waters for any mine effluent, Magela Creek, runs as a torrent in "the wet" and evaporates to isolated billabongs, teeming refugia, for the protracted "dry". The limnological regime equals the hydrological regime in severity. Waters concentrate, ionic character changes, nutrients burgeon, turbidity increases massively, and the euphotic zone contracts to a few red centimeters. Deeper billabongs exhibit de facto stratification, a notion demanding not lasting rigorous hydraulic cleavage but sufficient to permit expression of ecological derivitives such as anoxia. In this dynamic milieu, a rich phytoplankton flora waxes and wanes capriciously. Productivity, though high, is often impaired by the high turbidity. Nonetheless, empirical relationships between light, nutrients, biomas and productivity fit the temperate pattern.

Eat Your Way To Fitness - The Stonefly Diet Plan

Cathy Yule, Department of Applied Biology, RMIT.

The dietry habits of six species of Dinotoperla from Victoria were determined by field and laboratory observation, nymphal gut analysis and examination of mouthparts. All the species (D. bassae, D. brevipennis, D. christinae, D. eucumbene, , D. fontana and D. thwaitesi) could be classified as herbivore-detritivores, and in each there was a shift from a diet of primarily of fine particulate matter to a more polyphagous habit with increasing nymphal size.

The diets of the six species were similar, consisting of diatoms, filamentous green algae (except in D. eucumbene), fungal hyphae, fine particular matter and vascular plant tissue, However, differences were observed in the nutritional quality of their diets in terms of protein and calorific content. The two smallest species studied, D. brevipennis and D. eucembene consumed mostly detritus - the least nutritionally valuable of available food items (apart from wood which was not eaten by Dinotoperla nymphs). D. eucumbene was also the slowest growing of the six species. The fastest growing species, D. basse was also the largest and most successful in terms of population density, and the nymphs of this species consumed the highest quality diet, eating large amounts of filamentous algae and diatoms.

D. fontana and D. thwaitesi exhibited a very high degree of dietary overlap. These two common species were very similar with regard to their geographical distributions and their lifecycles. However, competition for food appears to have been eliminated by the fact that they occupied different parts of the streams in which they lived.

"And another thing. You'll find that once you let on you're a mayfly, insurance companies just don't want to know."

New Members

We are pleased to welcome the following new members to the Society :

Vincent Pettigrove
Greensborough, Victoria.

Graham Scarlett
Toongabbie, Victoria

Dr. Neil Hallam
Monash University

Peter Morrison
University of Western Australia

Geoffrey Tancred
Orange, New South Wales

Adrian Peck
CSIRO, Perth

Gary Morgan
Museum of Victoria

Dr. William Peters
Tallahassee, USA

Timothy Wrigley
Slacks Creek

Alan Gunn
CSIRO, Griffith, New South Wales

Phuoc Ngoc Le
Chisholm Institute of Technology

Chester Merrick
University of Adelaide

Dennis Steffinson
State Water Laboratorys, Sailsbury, South Australia

Brendon Atkins
University of Adelaide

Janette Shaw
Water Resources and Water Supply, Armadale

Dr. Dieter Diem
Chisholm Institute of Technology

Sandra Sdraulig
Chisholm Institute of Technology

Mr D M Woolford
Adelaide

Judith Hill
Fisheries and Wildlife, Shepparton

Thesis Abstracts

The Macroinvertebrate Contribution to Carbon and Phosphorus Dynamics of the Peel-Harvey Estuarine System.

A.J.Cheal, G.W.Connell, S. Creagh, P.G.Kendrick, P.G Mawson, I.M.P Schlawe, A.R.Silberstein J.J.Tongue and J Wilson, B.Sc. Honors Thesis, Zoology Department, University of Western Australia, 1983

Estimations of phosphorus and carbon biomass for the benthic macroinvertebrate and planktonic fauna of the Peel-Harvey esturine system were determined.

Quantification of the system's productivity was obtained by measurement of CO_2 metabolism, in terms of photosynthesis, community respiration and thus gross primary production and net community production.

Laboratory determinations of CO_2 respiration, phosphorus excretion and phosphous decompositional release of seven taxa were measured. Potential significance of invertebrates in community parameters of respiration and phosphorus was thus estimated.

Net flux of carbon and phosphorus was determined for the sediment-faunal complex. This estimate is representitive of in situ conditions and in relevant to the assessment of the benthic faunal contribution to the total system budget.

Determination of POP and TDP uptake and net P excretion for a benthic macroinvertebrate (and DIP uptake rate of Harvey diatomaceous phytoplankton communities) were carried out with the use of radioactive tracer (^{32}P)

Impact of Increased Flooding and Salinity on the Tree Vegetation of Lake Toolibin.

R.H.Froend, B.Sc.Hons Thesis, University of Western Australia, 1983.

The impact of increased flooding and salinity on the tree vegetation of an emphemeral lake in the Central West Australian wheat belt was studied. Species composition and vigor was shown to vary with elevation above the lake bed. The cause of mortality varied with the species in question and the elevation at which it occurred. Species typical of lower elevations showed low vigors in response to high soil salinities rather than to prolonged inundation. The cause of mortality at higher elevations however, can be attributed to both prolonged inundation and high soil salinities, depending of the species.

Experimental analysis of species salt and inundation tolerance showed that species typical of lower elevations were more tolerant of waterlogged and saline conditions. Salt and inundation tolerances reflected the ecotypic distribution of each species.

Maintenance of the lake environment was shown to be dependent upon the reduction of salt imput rather than reduction of lake levels.

Wetlands and Nutrients in the Harvey Catchment, Western Australia.

Jane M. Chambers, B.Sc. Hons thesis, 1982, Botany Department, University of Western Australia.

Three wetlands in the Harvey Catchment of the Peel-Harvey esturine system, Western Australia, were studied in terms of their hydrology, ecology and nutrient partitioning in order to determine whether the wetlands, or plants within the wetlands, could be used as "biological filters" to remove phosphorus from water entering this eutrophic estuary. Each of the wetlands studied had a similar bathymetry and vegetation composition and structure, consisting of a lake basin surrounded by a shallow floodplain covered in a swamp woodland association dominated by Melaleuca species.

The lake volumes of these three wetlands were highly dependent on rainfall and evaporation, peak volumes occuring in winter during periods of high rainfall and groundwater input. Phosphorus content of the lake water was found to be inversely proportional to the amount of vegetation surrounding the lake, the swamps having maximum phosphorus concentrations of 14, 0.4, 0.1 mg l^{-1}. Nutrient partitioning within the wetlands revealed the vegetation to have the highest concentration of phosphorus and nitrogen (up to 8 mg g^{-1} and 16 mg g^{-1} respectivly) and the water to have the lowest concentration. The ability of the vegetation to take up large quantities of nutrients demonstrates their importance in reducing the nutrient content of groundwater entering the wetlands from adjacent fertilized pastures. A sedge, common to these wetlands, Lepidosperma longitudinale, was found to have a phosphorus content of up to 8 mg g^{-1} and a productivity of up to 970 gm^{-2} 196 $days^{-1}$. Preliminary experiments on its nutrient removal capacity are in progress in order to determine whether in can be used in artificial wetland systems to remove phosphorus flowing into the many drains within this catchment. At present the wetlands within the catchment appear to be unsuitable for nutrient removal due to a large amount of clearing of the wetland vegetation.

The Ecology of Star Swamp and Surrounding Bushland.

Linda E Watson, B.Sc Hons. Thesis, 1983, Department of Botany, University of Western Australia.

Star Swamp and its watershed represents a remnant of a once extensive natural vegetation of the Swan Coastal Plain. As such it provides a natural, educational, passive

recreational, and aesthetic resource for its numerous users. Its future is threatened by an application to rezone the majority of the bushland to residential housing. This research then, was undertaken to provide baseline data in the formation of a landuse management programme to ensure the future preservation of the region.

Sixteen hectares, incorporating Star Swamp, were surveyed for environmental, edaphic and vegetational parameters. Correlations between three designated plant communities and the environmental and edaphic factors were analysed by means of a Polar Ordination.

A weed management control programme has been recommended, with specific reference to the control of Lagurus ovatus.

Reproductive Biology of the Fork-tailed Catfish Aurius australis (Ariidae) from the Clarence River, N.S.W.

Michael A. Rimmer, M.Sc. Thesis, 1983, Macquarie University.

Arius australis spawns annually in late November and early December when water temperatures reach 26°C. Ovarian development is rapid; mature oocytes range from 11.0 to 13.7mm in diameter (mean 12.2mm). Fecundity ranges from 40 to 122 (mean 70.5) and is linearly related to fish size. Smaller (up to 3.3mm diameter) hyaline oocytes are also produced in large numbers; the larger surface to volume of these oocytes appears to be necessary for the synthesis of sufficient gonadal steroids for reproduction. The pelvic fins of A. australis are sexually dimorphic; those of the female have secondary sex characteristics ('claspers') which vary in association with the reproductive cycle. Pre-spawning behaviour includes pursuit of the male by the female and increased sound production by the female using the pectoral spine mechanism.

Up to 83 eggs and larvae are incubated orally by the male for 6 to 8 weeks. Hatching takes place at 4 to 5 weeks, and juveniles are released when yolk absorbtion is complete, at up to 59mm total length. During the brooding period the male does not feed and the liver is utilised extensivly as an energy source. The buccal cavity of brooding males is distended in response to the large volume of eggs or young carried, and the palatine tooth patches are overgrown by the oral epithelium. Although the testes of brooding males are significantly larger than those of non-brooding males, this cannot be ascribed to the proliferation of a particular cell type.

Studies on the Taxonomy and Ecology of the Australian Siphlonuridae and Oligoneuriidae (Insecta : Ephemoptera).

Ian C. Campbell, Ph.D. Thesis, 1983, Department of Zoology, Monash University.

There are three genera of siphlonurid mayflies and one of oligonuriid mayflies present in Australia. They have been revised taxonomically with two new species belonging to the genus Coloburiscoides (Oligonuriidae), and one each belonging to the genera Ameletoides, Tasmanophlebia and Mirawara (all Siphlonuridae) being described. Nymphs of seven species had previously been described, and nymphs of a further six species are described, leaving only one unknown. The eggs of eleven of the species are also described.

Species distributions and nymphal habitats are more fully documented. Investigations of gut contents revealed that Ameletoides nymphs are epilithic browsers, Tasmanophlebia nymphs are collector gatherers, Coloburiscoides nymphs are filter feeders and Mirawara nymphs are carnivores, swallowing their prey whole.

Investigations of size relations of nymphal body parts showed that isometric growth was not common. A few nymphal structures displayed a simple allometric relationship with total body length but compound allometry was more common.

Imaginal emergence and oviposition behavior was conventional, but the number of eggs produced per female was very high compared with numbers from Northern Hemisphere species. This was probably due to the large size of the Australian species.

The life histories of nine populations, including seven different species were investigated in the field over approximately three years. The life histories were generally poorly synchronised. Adult emergence occured over five months or more for every population and the egg hatching periods were also quite extended. As a result a wide size range of nymphs were present in most populations for most of the year. These formed a series of multiple overlapping cohorts. The length of development time taken by different cohorts of a given population was quite varied.

Significant differences in the length and timing of the adult emergence period and of the importance of particular cohorts were apparent between years. It was concluded that more than a single year's data was required to correctly interpret the life histories of Australian mayflies.

Life history patterns of the mayflies investigated in this study could not be readily fitted in to classification systems proposed by Northern Hemisphere workers. The variability of the life histories of those Australian mayflies investigated so far makes it doubtful that any useful classificatory system can be developed for them.

Book Reviews

"SURVIVAL STRATEGIES OF THE ALGAE"

Edited by Greta A. Fryxell. Cambridge University Press 1983. Cost $48.00

Terrestrial and higher plant ecologists have recognised the importance of plant propagules (seeds, rhizomes, runners, spores) as units of dispersal and survival which may determine the potential populations of a habitat (e.g. Harper 1977, Silvertown 1982). To my knowledge this is the first book that deals exclusively with survival strategies in algae. The literature covering this subject is scattered through limnological, oceanographic, microbiological, physiological, phycological and palaeontological journals. It is therefore a pity that the Editor could not persuade Dr N.J. Lang to contribute a chapter on Cyanophytes, this problem is overcome partially by selected references to which I would add Reynolds et al. (1981) on Microcystis. Despite this shortcoming parts of this book make fascinating reading.

The first chapter by A.W. Coleman (who was working recently in Adelaide) deals with the chlorophytes. It points out that the most frequently transported organisms are not those with elaborate cell walls, but rather reflects the most abundant algae in soil and freshwater. There are good descriptions of the contents and structure of resting stages. I found the section on the factors leading to the development of thick-walled cells disappointing as there was little attempt to relate the various types of resting stages to their ecology. However, there are two hypotheses which would stimulate any reader. The first is the idea that in small-celled, gelatinous populations abundance in numbers may play the same role in the dispersal and maintenance of populations as does the formation of specialized resting stages. The second is the remarkable survival ability of thick-walled cells. The hypothesis is put forward that these may act as reservoirs of genetic information which are periodically released back into the population by disturbance of sediments.

Chapter 2 (C.D. Sandgren) looks at survival strategies of chrysophycean flagellates. It points out that resting stages are a necessary component of the life history strategies of many phytoplankton. It then launches into descriptions of the statospore, cyst morphology and the significance of statospores in the life history of chrysomonads with an emphasis on the genetic significance. For the limnologist there is an important section on encystment of natural chrysophycean populations. Although the data are sparse the treatment is thorough with reference to much unpublished work of the author. I was interested to learn that encystment frequency in the ephemeral population of Dinobryon cylindricum is 20%-30%, whereas in Synura spinosa which maintains a population for several months encystment frequencies are low (< 5%).

Diatom resting spores are the subject of Chapter 3. The treatment is biased towards oceanographic studies and no mention is made of the meroplanktonic existence of Melosira species in freshwaters (e.g. Lewis 1978). Despite this, the chapter is well written and includes many of the aspects covered in previous chapters on other groups. It gives a better coverage of the more ecological aspects of diatom encystment (e.g. sinking rates, factors inducing spore excystment, grazing interactions, survival time).

These three chapters all contain the same message, the subject is a potentially rewarding area for research but our knowledge of the ecological and physiological aspects of resting stages is scant.

The majority of the book (67 out of 144 pages) is devoted to the dinoflagellates. Much of the information contained within this chapter bears little relevance to the book's title. Sections on the history of dinoflagellate cyst studies; cyst terminology and morphology; cysts and dinoflagellate classification although interesting are not what I envisaged as subject matter for a book on "Survival Strategies of the Algae". The author also tries to draw a comparison between the biologists' and palynologists' approach to dinoflagellates - a potentially worthwhile interaction which this chapter does little to further. For those interested in the ecology of the dinoflagellate Ceratium hirundinella, I recommend the papers coming out of the Freshwater Biological Association, U.K. (e.g. Chapman et al. 1982, Heaney et al. 1983).

In conclusion I believe this book should be present on library shelves, bought by research workers interested in this area, and read by those who like myself are fascinated by survival strategies, you can always skip those sections which are irrelevant. One hundred and forty-four pages of photocopying costs $7.20.

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G.G. Ganf
Department of Botany,
University of Adelaide.

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A GUIDE TO THE FRESHWATER FISH OF VICTORIA.
Victorian Govt. Printing Office, Melbourne. 249 pp.

Available from Victorian Government Bookshop,
P.O. Box 203, North Melbourne, 3051.
Recommended Retail Price $13.50.

Reviewed by Helen Daly.

'A Guide to the Freshwater Fish of Victoria' is a welcome addition to the meagre body of literature which is currently available on our native freshwater fish fauna.

Its main aims are to enable identification of the fish species most likely to be encountered in the fresh or inland waters of Victoria, and to review current knowledge of their life histories. I believe that it succeeds in achieving these goals.

The book has several introductory sections aimed at the beginner, which include methods for collecting, keeping and photographing fish, and a brief account of the parasites most likely to be found on Victorian native freshwater fish. The basic structure and classification of fish are described, followed by a glossary of technical terms and some notes on how to use biological keys. A key to the families of fish occurring in the freshwaters of Victoria precedes the accounts of individual families and species.

Each section dealing with a particular family follows a standard format: a brief introduction to the family is followed by a key enabling species identification of the family members present in Victorian waters. The subsequent individual species accounts carry information under the headings : description, distinguishing features, distribution and abundance (which includes a distribution map for the species in Victoria), habitat, biological notes and references.

There are excellent colour photographs, by Günther Schmida and others, of live specimens of most of the species discussed in the book. These certainly enhance the book's usefulness.

It is obvious that much thought has gone into both the layout and content of this book, and I would recommend it to any scientist or lay person interested in our native fish fauna.

Limnology Bibliography

The following is the next installment of the bibliography on Australian Limnology. For the inclusion of references, please forward titles, abstracts, reprints or citations to Russell Tait, Esso Australia Ltd., GPO Box 4047, Sydney, 2001, N.S.W.

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News

TRICHOPTERA CONFERENCE

The Third Australian Trichoptera Conference was held at Halls Gap in the Grampians, western Victoria, over the weekend of 3-4 December 1983. Saturday was devoted to presentation of papers, followed by a pre-dinner wine and cheese session and a most enjoyable dinner at a local restaurant. Most registrants participated in an organised sampling trip on the Sunday, the success of which was guaranteed by the warm, sunny weather, the serene and picturesque location, and the tasty picnic lunch provided.

The following papers were presented:

Distribution of Trichoptera genera in the south-west Pacific area. Arturs Neboiss

Biogeography of Australian Hydroptilidae. Alice Wells

Life-histories of some Australian Trichoptera, with examples of temporal species replacement. John Dean

Temporary stream Trichoptera. Andrew Boulton

Longitudinal distribution of Trichoptera in the Yarra River. David Cartwright

Trichoptera of the Great Western Tiers, Tasmania. Frances Michaelis

The distribution of Oecetis in South Australia. John Lea

Larvae of the Victorian Hydropsychidae. John Dean

Contribution a l'etude des Leptoceridae d'Australie. Ros St.Clair

The Fourth Annual Conference will be held near Tarra Valley National Park, in south Gippsland, Victoria, on the weekend of 8-9 December 1984. Persons wishing to receive further information and/or registration forms should contact:

David Cartwright,
MMBW Laboratories,
GPO Box 4342
Melbourne, VICTORIA 3001

24th ANNUAL CONGRESS - PERTH 1985
23rd to 25th August

Jane Chambers reports that she has already received pre-registration forms back from 39 Eastern State members indicating that they will be attending the 1985 Congress in Perth. If you have not yet returned the form please do so as soon as possible. If you have lost it just send a note to Jane (Botany Department, University of W.A.) to let her know that you are coming. To encourage you the airfares as of June 1984 are listed below (courtesy of Jenny Davis).

Return airfares to Perth from Australian capital cities as provided by TAA, June, 1984.

CITY	NORMAL ECONOMY FARE	APEX FARE
Adelaide	$543.60	$353.30
Melbourne	$630.20	$409.60
Sydney	$706.60	$459.30
Hobart	$711.40	$462.40
Brisbane (via Adelaide)	$762.20	$495.40
Canberra	$692.60	$450.20
Darwin (via Port Headland)	$655.20	$425.90

A REQUEST FOR TEACHING MATERIALS

Many teachers of limnology, especially those in third world nations, feel a need for materials and ideas for courses in that field. The need became particularly apparent during the 1983 Congress of the International Society of Limnology (SIL) in Lyon, France. At that time the Society's "Working Group for Teaching in Limnology" decided to organize a reference base on available materials. Teachers with particular needs could then request sources in the areas of their needs. The sources would mainly be individuals who are willing to send information to their colleagues.

Do you have syllabi, laboratory notes, handbooks, exercise procedures, bibliographies, computer or calculator programs or anything else that would help someone in their efforts at teaching limnology? Would you be willing to send your resources to another teacher?

If you can help, please send a copy of what you have available or a description of it to

Dr. Mahlon G. Kelly,
Department of Environmental Sciences,
Clark Hall,
University of Virginia,
Charlottesville, VA 22903
U.S.A.

We cannot afford to maintain a collection of materials to be sent directly to those requesting them, but we can maintain a data base so as to match those requesting material to those willing to provide it.

This will only work if we receive a reasonable response from generous individuals over the next year or so. **PLEASE HELP US.** The availability of the reference base will be announced when it reaches sufficient size to be of general use.

Rare Stonefly Threatened?

The Forests Commission of Victoria which manages the Mt Donna Buang Scenic Reserve, is planning to construct another carpark in the area inhabited by the wingless stonefly Riekoperla darlingtoni. This stonefly, which is listed by the IUCN in the Invertebrate Red Data Book of rare and endangered species, is known from an area of only about one square kilometre near the summit of Mt Donna Buang. The Forests Commission have carried out a study of the area and produced an unreleased report which apparently recommends that the carpark should be constructed. No limnologists or entomologists familiar with stoneflies were consulted in the design of the study, and none have been given any opportunity to comment on the report.

Hamar Midgley AM

Members will be pleased to hear that Hamar Midgley has been appointed a member in the general division of the Order of Australia in the Queens Birthday honours list. The award was made for Hamar's contribution to the conservation of freshwater fish. On behalf of all of the members of the Society we extend our congratulations to Hamar.

Coming Events

28 to 29 August 1984

Ecological Society of Australia Meeting

Venue : Sydney

Theme : Are Australian Ecosystems Different ?

Details : Dr M. Westoby, Biology Dept , Macquarie University, North Ryde, NSW 2113.

27-31 August 1984

Conservation and Management of World Lake Environment

Venue : Shiga, Japan.

Details : Dr. Tatuo Kira, Chairman of the Executive Committee, c/- Shiga Prefectural Government, 4-1-1 Kyomachi, Otsu, Shiga 520, Japan.

12 - 14 September 1984

Freshwater Biological Monitoring

Venue : University of Wales, Cardiff, UK.

Details : Dr David Pascoe, Dept of Applied Biology, UWIST, King Edward VII Avenue, Cathays Park, Cardiff CF1 3NU, UK.

13-14 September 1984.

Conservation and the Economy.

Venue : Masonic Centre, Sydney,

Details : Mr G. Upstill, Environment Studies Branch, Department of Home Affairs and Environment, GPO Box 1252, Canberra, ACT 2601.

22-23 November 1984

The changing needs of the Australian Water Supply & Sewerage Industry.

Venue : Adelaide.

Details : The Secretary, The Institution of Engineers, 11 Bagot St., North Adelaide, 5006.

22-24 November 1984

14th Annual Symposium on the Analytical Chemistry of Pollutants.

Venue : Barcelona, Spain.

Details : Expoquimia, Av Reina Ma. Cristina, Palacio No.1 Barcelona (4), Spain.

27-28 November 1984

Freshwater Ecotoxicology in Australia.

Venue : Chisholm Institute of Technology, Melbourne.

Details : Tom Davies, Water Studies Centre, Chisholm Institute of Technology, PO Box 197, East Caulfield, 3145.

8-9 December 1984.

Fourth Annual Trichoptera Conference.

Venue : Tarra Valley National Park, Victoria.

Details : David Cartwright, MMBW Laboratories, GPO Box 4342, Melbourne 3001.

12-16 February 1985.

Environment for Life : International Conference on Environmental Management in Developing Countries.

Venue : Manila, Philipines.

Details : Infinity Plus, Unit 7E Vernida I Building, 120 Amorsolo Street, Legaspi Village, Makati, Metro Manila, Philipines.

February 1985

River Ecology and In-stream Issues

Venue : Chisholm Institute of Technology, Melbourne.

Details : Ian Campbell, Water Studies Centre, Chisholm Institute of Technology, East Caulfield, 3145.

28 April - 1 May 1985.

Arctic Water Pollution Research : Applications of Science and Technology.

Venue : Yellowknife, Canada.

Details : K. Charbonneau, Conference Services Division, National Research Council of Canada, Montreal Road Laboratories, Ottawa, Ontario, Canada.

28 April - 5 May 1985

11th Federal Convention AWWA

Venue : Melbourne

Details : F.J. Carter, Secretary, AWWA, Box A232 PO Sydney South, 2001.

6-9 May 1985.

2nd International Symposium on Toxicity Testing Using Bacteria.

Venue : Banff, Canada.

Details : B. Dutka, AMD, National Water Research Centre, CCIW , PO Box 5050, Burlington, Ontario, Canada L7R 4A6.

4-7 June 1985.

Effects of Land Use on Fresh Waters.

Venue : University of Stirling, UK.

Details : Eric Porter, Water Research Centre, PO Box 16, Henley Road, Medmenham, Marlow, Bucks. SL7 2HD, UK.

7-20 July 1985.

Sixth International Seminar on Environmental Impact Assessment.

Venue : University of Aberdeen, Scotland.

Details : Centre for Environmental Management and Planning, University of Aberdeen, Scotland.

10-13 September 1985.

Chemistry for Protection of the Environment.

Venue : Leuven, Belgium.

Details : %th International Conference of Chemistry for Protection of the Environment, c/- K. VIV, Jan van Rijswijcklaan 58, B-2018 - Antwerpen, Belgium.

23rd - 25th August 1985.

24 Annual Congress, Australian Society for Limnology.

Venue : Western Australia.

Details : Jane Chambers, Botany Dept., University of Western Australia, Nedlands 6009.

10-16 August 1986

Global Connections in Ecological Theory and Practice.

Venue : State University of New York, USA.

Details : IV International Congress of Ecology, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210, USA.

8 to 14 February 1987.

XXIII Congress of the International Association of Theoretical and Applied Limnology (S.I.L.)

Venue : Hamilton, New Zealand.

Details : Theme : Water, to use and enjoy. Further information will become available through Tyler.

February 1987

Fifth International Conference on Ephemeroptera.

Venue : Marysville, Victoria.

Details : Dr I. Campbell, Water Studies Centre, Chisholm Institute of Technology, East Caulfield 3145.

February 1987

Ninth International Conference on Plecoptera.

Venue : Marysville, Victoria.

Details : Dr I. Campbell, Water Studies Centre, Chisholm Institute of Technology, East Caulfield 3145.

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